

IDENTIFICATION, DISTRIBUTION, AND HABITAT OF COREOPSIS  
SECTION EUBLEPHARIS (ASTERACEAE) AND DESCRIPTION  
OF A NEW SPECIES

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ABSTRACT

Species of *Coreopsis* occurring on the North American coastal plain continue to present identification challenges. Here we provide a revised key, identification notes, habitats, and range maps for nine species. *Coreopsis aristulata* LeBlond, Sorrie & Weakley is newly described here.

RESUMEN

Las especies de *Coreopsis* de la llanura costera Norte Americana continúan presentando problemas de identificación. Aportamos aquí una clave revisada, notas de identificación, hábitats, y mapas de distribución de nueve especies. Se describe como nueva *Coreopsis aristulata* LeBlond, Sorrie & Weakley.

INTRODUCTION

*Coreopsis* is a genus of 35 species, 28 in North America and seven in the neotropics and paleotropics (Strother 2006). Section *Eublepharis* Nutt. is strictly eastern North American, ranging on the coastal plain from southern Nova Scotia to southern Florida and eastern Texas. There has been limited agreement on the number of species that previous authors recognized (Table 1), with disagreement centering on *C. gladiata*, *C. linifolia*, *C. helianthoides*, and *C. floridana*. In our view, the recent treatments by Cronquist (1980) and Strother (2006) recognize too few species, compared with the number that we routinely identify during field and herbarium work throughout the southeastern coastal plain. We base our conclusions on the consistency within each species regarding plant morphology (several characters), habitat fidelity, and coherent geographical distribution. Our conclusions, presented below, are largely supported by molecular work using sequences from nuclear ITS and plastid regions (Crawford & Mark 2005), who report a well-resolved phylogeny of the genus in eastern North America, including monophyly of section *Eublepharis*. The authors sampled five species within this section: *C. floridana*, *C. gladiata*, *C. integrifolia*, *C. linifolia*, and *C. rosea*. However, Crawford and Mark stated that "additional field and laboratory studies are needed to elucidate relationships in this species complex." In this paper we provide rationale for recognizing nine species in section *Eublepharis*: *C. falcata* F.E. Boynton, *C. floridana* E.B. Smith, *C. gladiata* Walter, *C. integrifolia* Poir., *C. linifolia* Nutt., *C. nudata* Nutt., *C. palustris* Sorrie (= *C. helianthoides* Beal, *C. gladiata* misapplied), *C. rosea* Nutt., and *C. aristulata* LeBlond, Sorrie & Weakley (newly described below). *Coreopsis longifolia* Small and several other taxa not recognized here are synonymized in the treatment which follows.

METHODS

The current study was conducted primarily by the first author over a period of twenty years while gathering specimen information on endemic species of the North American coastal plain. Specimens annotated by E.B. Smith served as a baseline, augmented by newly constructed keys and annotations of specimens accessioned since Smith's work. Smith (1976) provided illustrations, including achenes, for seven species; Godfrey and Wooten (1981) illustrated six species. These drawings were critical to forming working concepts of "typical" examples of the species; herbarium specimens provided data on variation within each species. Measurements were made of 20–25 mature achenes (1–2 per specimen) from specimens at NCU. Smith (1976, 1978) cited



TABLE 1. Species of *Coreopsis* section *Eublepharis* recognized by various authors. \* = described in 1976. # = not known from flora area at the time, but subsequently documented.

	Small 1933	Sherff 1936	Radford et al. 1968	Smith 1976	Cronquist 1980	Strother 2006	Sorrie et al. this paper
<i>aristulata</i>	—	—	—	—	—	—	X
<i>falcata</i>	X	X	X	X	—	—	X
<i>floridana</i> *	—	—	—	X	—	—	X
<i>gladiata</i>	X	X	X	X	X	X	X
<i>integrifolia</i>	X	X	— #	X	X	X	X
<i>linifolia</i>	X	X	X	X	X as var. of <i>gladiata</i>	—	X
<i>longifolia</i>	X	X	—	—	—	—	—
<i>nudata</i>	X	X	—	X	X	X	X
<i>palustris</i> ( <i>helianthoides</i> )	X	X	X	—	X	—	X
<i>rosea</i>	X	X	— #	X	X	X	X

types, which we have seen in hand or online. Specimens were examined at DUKE, FLAS, FSU, GA, GH, MO, NCSC, NCU, NY (types online), US (types online), and USCH. Maps were produced using a program created by Mike Lee of University of North Carolina, Chapel Hill.

## RESULTS AND DISCUSSION

**Achene morphology**

Achenes of *Coreopsis* section *Eublepharis* are notable for their pectinate wings, absent only in *C. rosea*. The achene body has numerous processes on the lateral margins that form the wings; these processes may be narrow and sharply pointed, but in most species are broader and truncate-tipped or notched. The achene body is surmounted by a pappus composed of two sharply pointed awns. Smith (1976) and Godfrey & Wooten (1981) provide excellent illustrations of achenes of most species. Achene morphology can provide important secondary identification characters, in addition to those in the key below. For example, *C. rosea* achenes lack wings and awns, *C. linifolia* wings have sharply pointed processes, *C. integrifolia* has markedly long achenes and very short awns, and *C. falcata* has markedly broad wings. Table 2 gives mensural data for several achene characters.

## KEY TO THE SPECIES

1. All major cauline leaves opposite (excluding basal and lowermost leaves of *C. integrifolia* and *C. linifolia*).
  2. Ray ligules pink to rosy (rarely white); leaf blades linear, the lowermost oblanceolate \_\_\_\_\_ ***C. rosea***
  2. Ray ligules yellow; leaf blades linear-oblanceolate to linear, or ovate.
    3. Blades ovate (to elliptical), very gradually reduced upward, margins ciliolate, surfaces lacking minute dark dots; achenes average about 5 mm long \_\_\_\_\_ ***C. integrifolia***
    3. Blades linear-oblanceolate to linear, rapidly reduced upward, margins glabrous, surfaces with numerous minute dark dots (easiest to see on abaxial surface); achenes average less than 2.5 mm long \_\_\_\_\_ ***C. linifolia*, in part**
1. All major cauline leaves alternate (only one or a few lower leaves alternate in *C. linifolia*).
  4. Leaves junciform (linear-terete); ray ligules pink to deep rosy (rarely white) \_\_\_\_\_ ***C. nudata***
  4. Leaves not junciform, with expanded blades, blades linear-oblanceolate to linear or broader; ray ligules yellow.
    5. Outer phyllaries deltoid and short, less than 0.3x length of inner phyllaries; flowering late Sep–Feb; endemic to Florida \_\_\_\_\_ ***C. floridana***
    5. Outer phyllaries lanceolate, 0.4–0.8x length of inner phyllaries; flowering May–early Nov; distribution various.
      6. Basal and lower leaves (at least 4 nodes) absent at anthesis; plants of swamp forests, streamside openings, and fresh-tidal creek margins OR of calcium-influenced acidic savannas.
        7. Mid-cauline leaves broadly (to narrowly) elliptical; achene awns average 0.8 mm; plants of swamp forests and streamside openings, fresh-tidal creek margins, rarely in calcium-influenced acidic savannas; ranges from se NC-ne FL \_\_\_\_\_ ***C. palustris***
        7. Mid-cauline leaves narrowly linear to linear-oblanceolate; achene awns average 0.3 mm; plants of calcium-influenced acidic savannas; restricted to se NC \_\_\_\_\_ ***C. aristulata***
      6. Basal and lower leaves present at anthesis; leaves rapidly reduced upwards such that mid-cauline leaves are slender; plants of wet savannas, seepage slopes, pitcher-plant bogs, streamhead ecotones, pocosin ecotones.
        8. Lower cauline leaves with numerous minute dark dots (easiest to see on abaxial surface); heads (including



TABLE 2. Achene characters of *Coreopsis* section *Eublepharis*, based on 20–25 measurements, in millimeters. Only mature achenes were sampled.

	achene body length	achene body width	wing width	awn length
<i>aristulata</i>	3.3–3.4 $\bar{x}$ = 3.4	0.8–1.1 $\bar{x}$ = 1.0	0.2–0.2 $\bar{x}$ = 0.2	0.2–0.3 $\bar{x}$ = 0.3
<i>falcata</i>	2.9–4.0 $\bar{x}$ = 3.3	0.9–1.1 $\bar{x}$ = 1.0	1.0–1.1 $\bar{x}$ = 1.0	0.3–0.7 $\bar{x}$ = 0.5
<i>floridana</i>	3.7–4.3 $\bar{x}$ = 4.0	1.1–1.3 $\bar{x}$ = 1.2	0.3–0.5 $\bar{x}$ = 0.4	0.8–1.2 $\bar{x}$ = 1.0
<i>gladiata</i>	2.8–4.2 $\bar{x}$ = 3.6	0.9–1.6 $\bar{x}$ = 1.2	0.1–0.4 $\bar{x}$ = 0.3	1.0–2.0 $\bar{x}$ = 1.5
<i>integrifolia</i>	4.3–5.5 $\bar{x}$ = 5.0	0.9–1.3 $\bar{x}$ = 1.1	0.3–0.4 $\bar{x}$ = 0.3	0.5–1.0 $\bar{x}$ = 0.7
<i>linifolia</i>	2.0–3.0 $\bar{x}$ = 2.4	0.9–1.0 $\bar{x}$ = 1.0	0.3–0.4 $\bar{x}$ = 0.4	1.0–1.9 $\bar{x}$ = 1.4
<i>nudata</i>	2.6–3.7 $\bar{x}$ = 3.0	0.9–1.2 $\bar{x}$ = 1.0	0.4–0.6 $\bar{x}$ = 0.5	1.0–1.5 $\bar{x}$ = 1.2
<i>palustris</i> ( <i>helianthoides</i> )	2.8–3.8 $\bar{x}$ = 3.5	1.0–1.8 $\bar{x}$ = 1.3	0.4–0.6 $\bar{x}$ = 0.5	0.6–1.0 $\bar{x}$ = 0.8
<i>rosea</i>	1.7–3.5 $\bar{x}$ = 2.0	0.6–0.9 $\bar{x}$ = 0.7	absent	absent

- extended rays) 2.5–4.0 cm diameter; median and upper leaves opposite, one to few lower leaves alternate; achene awns average 1.4 mm \_\_\_\_\_ **C. linifolia** in part
8. Lower cauline leaves without dark dots; heads 3.5–6.0 cm diameter; all major leaves alternate; achene awns average 1.5 mm or 0.5 mm.
9. At least one major leaf per plant with one or more slender lobes near base; achene wing broad,  $\geq \frac{3}{4}$  width of achene body; achene awns average 0.5 mm; plants blooming early May–early Jul \_\_\_\_\_ **C. falcata** in part
9. Leaves without basal lobes; achene wing variable; achene awn length variable; blooming period variable.
10. Achene wing broad,  $\geq \frac{3}{4}$  width of achene body; achene awns average 0.5 mm; leaf texture firm but not thick and leathery; plants blooming early May–early Jul \_\_\_\_\_ **C. falcata** in part
10. Achene wing narrow,  $< \frac{1}{2}$  width of achene body; achene awns average 1.5 mm; leaf texture thick and leathery; plants blooming early Sep–early Nov \_\_\_\_\_ **C. gladiata**

Specimens of an unfamiliar *Coreopsis* were found by Richard LeBlond in southeastern North Carolina in 1996.

It is describe as follows:

**1. *Coreopsis aristulata*** LeBlond, Sorrie & Weakley, sp. nov. (Figs. 1, 2). TYPE: U.S.A. NORTH CAROLINA. Onslow Co.: Sandy Run Swamp Powerline Savanna natural area, with *Myrica cerifera*, *Helianthus angustifolius*, *Lespedeza cuneata*, *Eragrostis elliotii*, *Panicum virgatum* var. *virgatum*, 4 Oct 1996, LeBlond 4654 (HOLOTYPE: NCU).

Differs from *C. palustris* in the following combination of characters: Early-deciduous lower leaves of *aristulata* plants resemble *C. palustris* Sorrie (= *C. helianthoides* Beadle misapplied), but differ markedly in the extremely narrow leaves, very short achene awns, and in habitat.

Plants rhizomatous; rhizomes to 14+ cm, 2 mm wide, these and the roots yellow to ochre. Caudex either fastigiated with roots or hardly distinguishable from lower stem. Stems glabrous, 80–110 cm long, 2–3 mm wide at base, 10–13 nodes below inflorescence. Cauline leaves gradually reduced upwards, stem base and lowest 4–6 nodes leafless at anthesis. Petioles 2.0–3.5 cm long, leaf tissue decurrent all of petiole length, bases sheathing stems, sheaths 1–2 mm long. Blades glabrous, linear to linear-oblong, 8–15+ cm long by 2–9 mm wide, 20–50  $\times$  as long as wide, thick, stiff, brittle when dry, surfaces smoothish (not scabrous or hairy), margins minutely scabrid. Inflorescence 15–50 cm long, open, corymbose, heads ca. 3.5–4.5 cm wide between tips of opposite rays. Outer phyllaries narrowly lance-oblong, blunt, 3–4 mm long by 0.8–1 mm wide at midpoint, 0.4–0.6 as long as the inner; inner phyllaries ovate-oblong, tapered to blunt tips, 6–7.5 mm long, 3–4.2 mm wide at widest point. Achene bodies oblanceolate-oblong, (3.0–)3.2–3.8 mm long, (0.8–)1.0–1.1 mm wide (not including wings); awns 0.2–0.4 mm long; wings 0.1–0.3 mm wide, pectinate-lacerate.

PARATYPES: U.S.A. North Carolina. Onslow Co.: Haws Run Mitigation Site natural area, between Sandy Run Swamp and Shelter Swamp Creek. With *Allium* sp. nov. aff. *cernuum*, *Thalictrum cooleyi*, *Fuirena breviseta*, *Andropogon glaucopsis*, *Fimbristylis autumnalis*, *Anthenantia rufa*, 19 Sep 1996, LeBlond 4600 (NCU); Haws Run Mitigation Site natural area, between Sandy Run Swamp and Shelter Swamp Creek, 3 Oct 2000, LeBlond 5424 A, -B, -C, -D (NCU). Pender Co.: Shaken Creek Preserve, shallow depression in wet savanna, with *Thalictrum cooleyi*, *Muhlenbergia expansa*, *Panicum virgatum* var. *virgatum*, 23 Oct 2011, R. Thornhill s.n. (NCSC, NCU).

**Distinguishing Characters.**—*Coreopsis palustris* and *C. aristulata* are the only species in section *Eublepharis* with lower leaves deciduous at anthesis. Typically, 4–6 nodes lack leaves or have one or two shriveled senescent leaves. This is a striking character and immediately separates these two species from congeners in the field and in herbaria. The two species can be distinguished by the characters in Table 3.



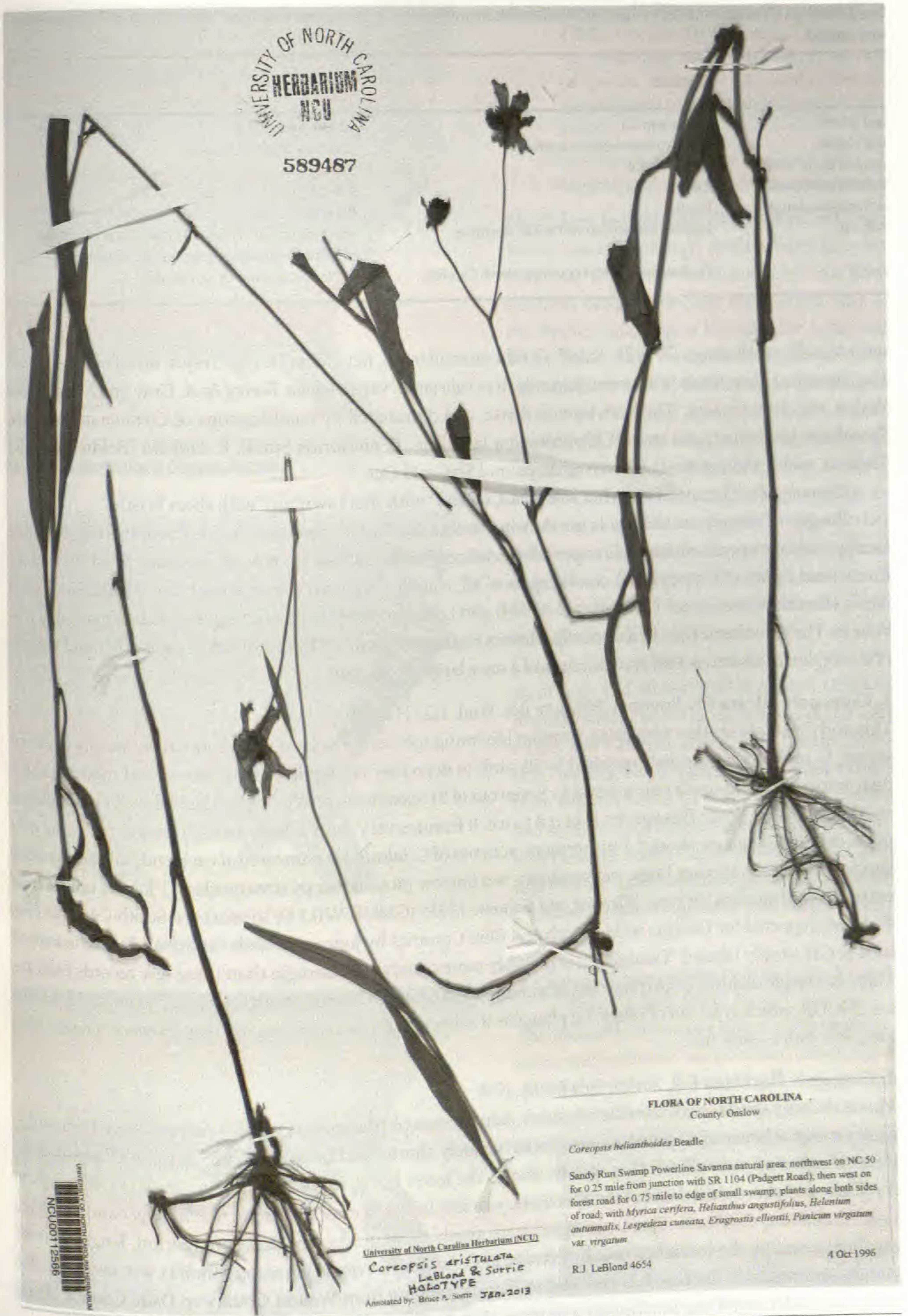


FIG. 1. Habit of *Coreopsis aristulata*.

Note that leaf width and achene awn length do not overlap between the two species; in fact, awn length of *C. aristulata* is only 38% of that of *C. palustris*. The narrow leaves of *C. aristulata* are similar to those of the narrow-leaved extreme of *C. gladiata* (described as *C. longifolia* Small), and specimens of the latter may be mistaken for the former. However, leaf blades of *C. aristulata* are even longer and more nearly linear than those of "*C. longifolia*", the lowest 4–6 leaves are absent at anthesis (vs. present), and the achene awns are strikingly short (mean 0.3 mm vs. 1.5 mm).

*Habitat and Flowering Dates.*—*Coreopsis aristulata* occurs in the Very Wet Loamy Pine Savanna natural community type (Schafale 2012), equivalent to the *Pinus palustris*—*Pinus serotina*/*Magnolia virginiana*/*Sporobolus teretifolius*—*Carex striata* Woodland (CEGL004500) (NatureServe 2012). Community structure in unaltered habitats is characterized by an open to sparse canopy dominated by *Pinus serotina* Michx., and usually with some *P. palustris* P. Mill. and *Taxodium ascendens* Brongn. The shrub layer typically is sparse to patchy,





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589487

FLORA OF NORTH CAROLINA  
County: Onslow

*Coreopsis helianthoides* Beadle

Sandy Run Swamp Powerline Savanna natural area, northwest on NC 50 for 0.25 mile from junction with SR 1104 (Padgett Road), then west on forest road for 0.75 mile to edge of small swamp, plants along both sides of road; with *Myrica cerifera*, *Helianthus angustifolius*, *Helentium autumnalis*, *Lespedeza cuneata*, *Eragrostis elliottii*, *Panicum virgatum* var. *virgatum*

R.J. LeBlond 4654

4 Oct 1996

University of North Carolina Herbarium (NCU)  
***Coreopsis aristulata***  
LeBlond & Sorrie  
**HOLOTYPE**  
Annotated by: Bruce A. Sorrie Jan. 2013

UNIVERSITY OF NORTH CAROLINA HERBARIUM  
NCU00112566

FIG. 2. Holotype of *Coreopsis aristulata* LeBlond, Sorrie & Weakley.



TABLE 3. Characters of *Coreopsis aristulata* vs. *C. palustris*. Measurements are in millimeters. Achene measurements do not include the wings. Only mature achenes were sampled.

	<i>C. aristulata</i>	<i>C. palustris</i>
leaf width	2–9; mean 5.1	13–39; mean 22.5
leaf shape	linear to linear-oblongate	narrowly elliptic to ovate
achene body length	(3.0–)3.2–3.8	3.0–4.1
achene body width	0.8–1.1	1.0–1.6
achene awn length	0.2–0.4	0.7–1.0
habitat	calcium-influenced wet acidic savannas	wet margins of creeks and rivers; one population in calcium-influenced wet acidic savanna
range	Onslow and Pender counties, North Carolina	se North Carolina to ne Florida

with *Morella caroliniensis* (P. Mill.) Small, *Cyrilla racemiflora* L., *Ilex glabra* (L.) A. Gray, *I. myrtifolia* Walt., and *Vaccinium fuscatum* Aiton prominent. Juvenile *Acer rubrum* L. var. *trilobum* Torrey & A. Gray and *Nyssa biflora* Walter are often present. The herb layer is dense, and dominated by combinations of *Ctenium aromaticum*, *Sporobolus pinetorum*, and several *Rhynchospora* taxa [e.g., *R. pinetorum* Small, *R. latifolia* (Baldwin ex Ell.) Thomas, and *R. thornei* Kral]. Flowering dates: mid Sep–mid Oct.

*Etymology*.—The specific epithet, *aristulata*, means “with short awn” or “with short bristle.”

*Range*.—*Coreopsis aristulata* occurs only in Onslow and Pender counties, North Carolina (Fig. 3). Other locally endemic species share this range and specialized habitat: *Allium* sp. nov. aff. *cernuum* Roth (Alliaceae), *Carex lutea* LeBlond (Cyperaceae), *Scleria* sp. nov. aff. *elliottii* Chapman (Cyperaceae), and *Thalictrum cooleyi* Ahles (Ranunculaceae); see LeBlond et al. (1994) and LeBlond (2001) for a discussion of this remarkable ecosystem. The three localities cited under Specimens Examined occur within eight km of each other and are part of a complex of savannas that are remnants of a once larger ecosystem.

## 2. *Coreopsis falcata* F.E. Boynton, Biltmore Bot. Stud. 1(2):141. 1902.

This and *C. nudata* are the only spring/summer blooming species in the section and both have basally disposed leaves. *C. nudata* is easily distinguished by its pink to deep rosy ray ligules, terete leaves, and more southern distribution; the two species are allopatric. Seven out of 51 specimens at NCU lacked leaf lobes (or we could not see them clearly); hence this species is keyed twice. It features very short achene awns, averaging 0.5 mm; only those of *C. aristulata* are shorter. Furthermore, achenes of *C. falcata* are truncated at each end, unlike any other species. It inhabits seepage bogs, wet savannas, wet borrow pits, and seepy streamsides. *C. falcata* ranges from extreme southeastern Virginia [Fleming and Caljouw 10435 (GMUF, WILLI)] to southern South Carolina (Fig. 4). It was reported for Georgia in McIntosh and Bibb Counties by Jones and Coile (1988) and there is a specimen at GH simply labeled “Georgia”; it is possibly more common in Georgia than these few records indicate. There is a single disjunct occurrence in the mountains of Oconee County, South Carolina [“Seneca”, McCarthy s.n. (NCU)], which is far out of range but plausible if collected in a montane seepage bog. Flowering dates: early May–late June(–early Jul).

## 3. *Coreopsis floridana* E.B. Smith, Sida 6:192. 1976.

This is the only species with consistently short, deltoid outer phyllaries. It resembles narrow-leaved forms of *C. gladiata*, but achenes of *C. floridana* are proportionately shorter and broader, resulting in an elliptical shape rather than a narrowly elliptical or spindle shape. The lower leaves in the drawing in Smith (1976) represent the wide- and short-bladed end of the spectrum, whereas leaves of most plants are much longer and narrower, thus resembling *C. falcata*. These two species are amply distinguished by flowering period, length of outer phyllaries, and by the leaf lobes usually present in *C. falcata*. *Coreopsis floridana* inhabits wet savannas, flatwoods, and roadside ditches. It is endemic to Florida, ranging from Walton County to Dade County, absent from the north central and northeastern counties (Fig. 5). Flowering dates: late Sep–Feb.





FIG. 3. Known distribution of *Coreopsis aristulata*.

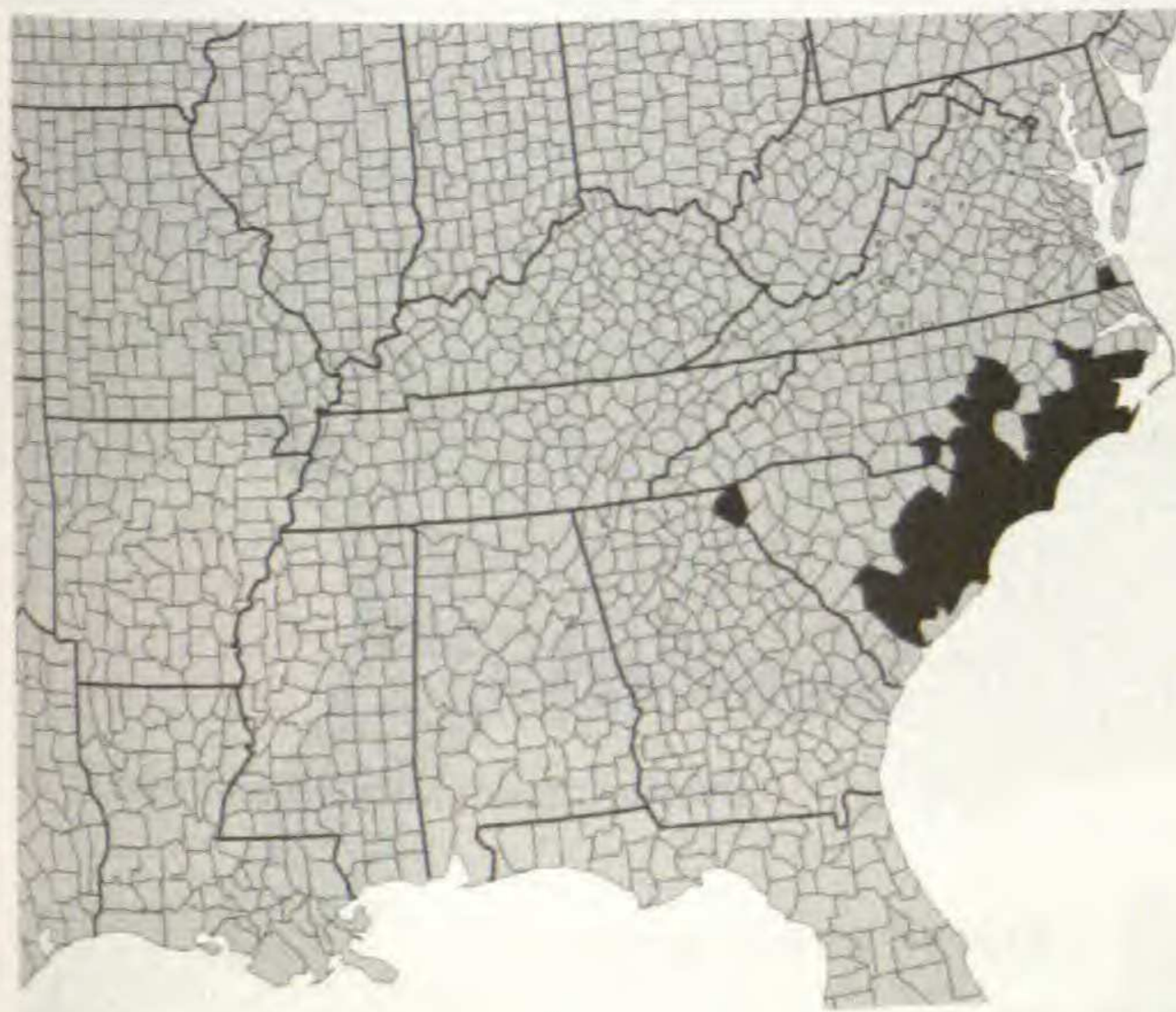


FIG. 4. Known distribution of *Coreopsis falcata*.



FIG. 5. Known distribution of *Coreopsis floridana*.

4. *Coreopsis gladiata* Walter, Fl. Carol. 215. 1788. TYPE: SOUTH CAROLINA. GEORGETOWN Co.: grass-sedge bog or savannah, 12 mi N of Georgetown, 15 Sep 1939, R.K. Godfrey 8238 (NEOTYPE, designated by Smith 1976: F; ISONEOTYPES MO!, TENN).

*Coreopsis angustifolia* Dryand, *C. dichotoma* Michx., *C. longifolia* Small, and *C. longifolia* var. *godfreyi* Sherff

Most plants have broadly elliptic basal and lower leaves and are strikingly distinct from all other taxa; only *C. palustris* (= *helianthoides*) may have similarly broad leaves, but those occur only in the mid-cauline region because the basal and lower leaves have senesced by anthesis. *Coreopsis gladiata* and *C. linifolia* have the longest achene awns of this group: 1.5 and 1.4 mm, respectively. Plants originally described as *C. longifolia* Small represent the narrow extreme of leaf width; achene morphology appears to be identical and we are unable to detect other differences. This narrow leaved variant appears more-or-less throughout the range, but is most often encountered in peninsular Florida. *Coreopsis gladiata* is most frequent in the East Gulf Coastal Plain, where it inhabits wet pitcher-plant bogs and streamhead seepages. Disjunct populations occur in the mountains of the Carolinas and Georgia, where they inhabit montane seepage bogs. *Coreopsis gladiata* ranges from eastern South Carolina to north Florida and southeastern Mississippi; disjunct to montane Georgia, South Carolina, and North Carolina (Fig. 6). It should be sought in southeastern Louisiana. Flowering dates: mid August–early November.

5. *Coreopsis integrifolia* Poir. ex Lam., Encycl. Suppl. 2, 352. 1811.

This species is distinctive in its strictly opposite, ovate, and uniformly small-bladed leaves. *Coreopsis integrifolia* is rare and local, known from six counties in northern Florida, five in southern Georgia, and four in southeastern South Carolina (Fig. 7). We have not been able to verify a report from North Carolina (Strother 2006). It inhabits semi-open floodplains and floodplain margins, powerlines and gaslines through swamp forests, and streamside seepages. This species appears to prefer calcareous soils. Flowering dates: mid August–early November.



**6. *Coreopsis linifolia*** Nutt., J. Acad. Nat. Sci. Philadelphia 7:75. 1834.

*Coreopsis callosa* Bertol., *C. gladiata* var. *linifolia* (Nutt.) Cronquist, *C. onisocarpa* Fernald, *C. onisocarpa* var. *simulans* Fernald, *C. saxicoloidea* Sherff

In the field this species and *C. rosea* usually are distinctly shorter than the other species in the section, much less than a meter tall. *Coreopsis gladiata* and *C. linifolia* have the longest achene awns of the group: 1.5 and 1.4 mm, respectively. The mid and upper stem leaves of *C. linifolia* are opposite, but lower leaves may be alternate; thus it is keyed twice. A unique character of *C. linifolia* is the presence of numerous dark dots on the leaf surfaces, seen best abaxially via transmitted light. Smith (1976) documents the existence of two chromosome races: a Gulf Coastal Plain diploid race (*linifolia*) and a southern Atlantic Coastal Plain tetraploid race (*onisocarpa*, originally described as *C. onisocarpa* by Fernald (1938)). The two races are separated by a slender gap between Leon County, Florida and Brooks County, Georgia; it is not known whether this gap is real or a collecting anomaly. Fernald treated the two races as species, but, like Smith, we are unable to discern any differences in achene, leaf, or floral morphology. *Coreopsis linifolia* has the widest range of any species in the section: southeastern Virginia to north Florida to east Texas (Fig. 8). Smith (1976) maps this species in Bartow County in northwest Georgia, but we have seen no voucher specimen. It inhabits moist to wet savannas, flatwoods, pitcher-plant bogs, and streamhead ecotones. Flowering dates: early Jul–late Oct.

**7. *Coreopsis nudata*** Nutt., Gen. N. Amer. Pl. 2:180. 1818.

With its basally disposed terete leaves and pink to deep rosy ray ligules, *C. nudata* is strikingly distinct. Along with *C. palustris*, it has the widest achene wings in the section, 0.3–0.5 mm. It ranges from southeastern Georgia to north Florida, west to southeastern Louisiana (Fig. 9). *Coreopsis nudata* inhabits pond cypress depressions, pond cypress stringers, wet roadside ditches, and intermittently ponded flatwoods. Flowering dates: late March to late May.

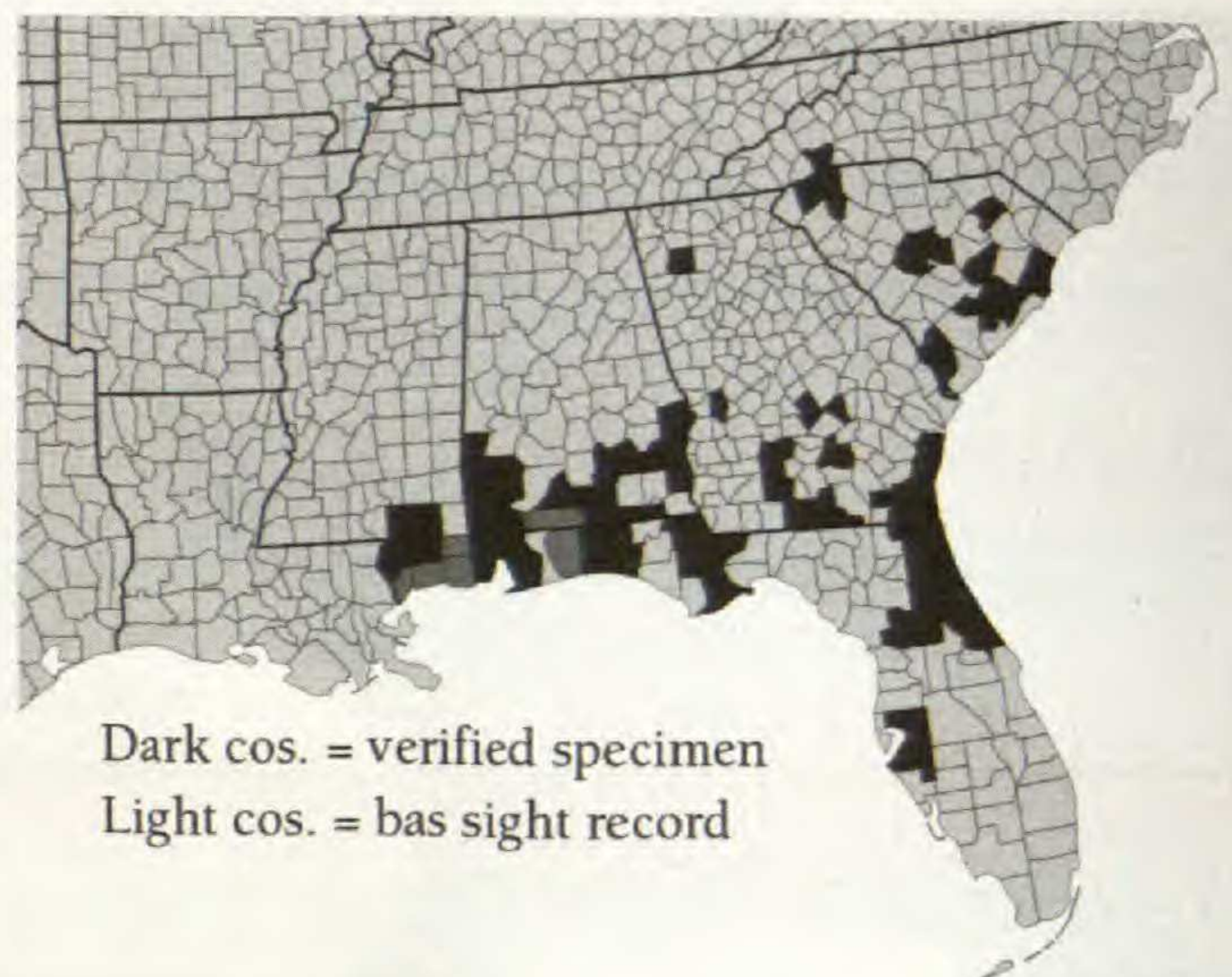


FIG. 6. Known distribution of *Coreopsis gladiata*.

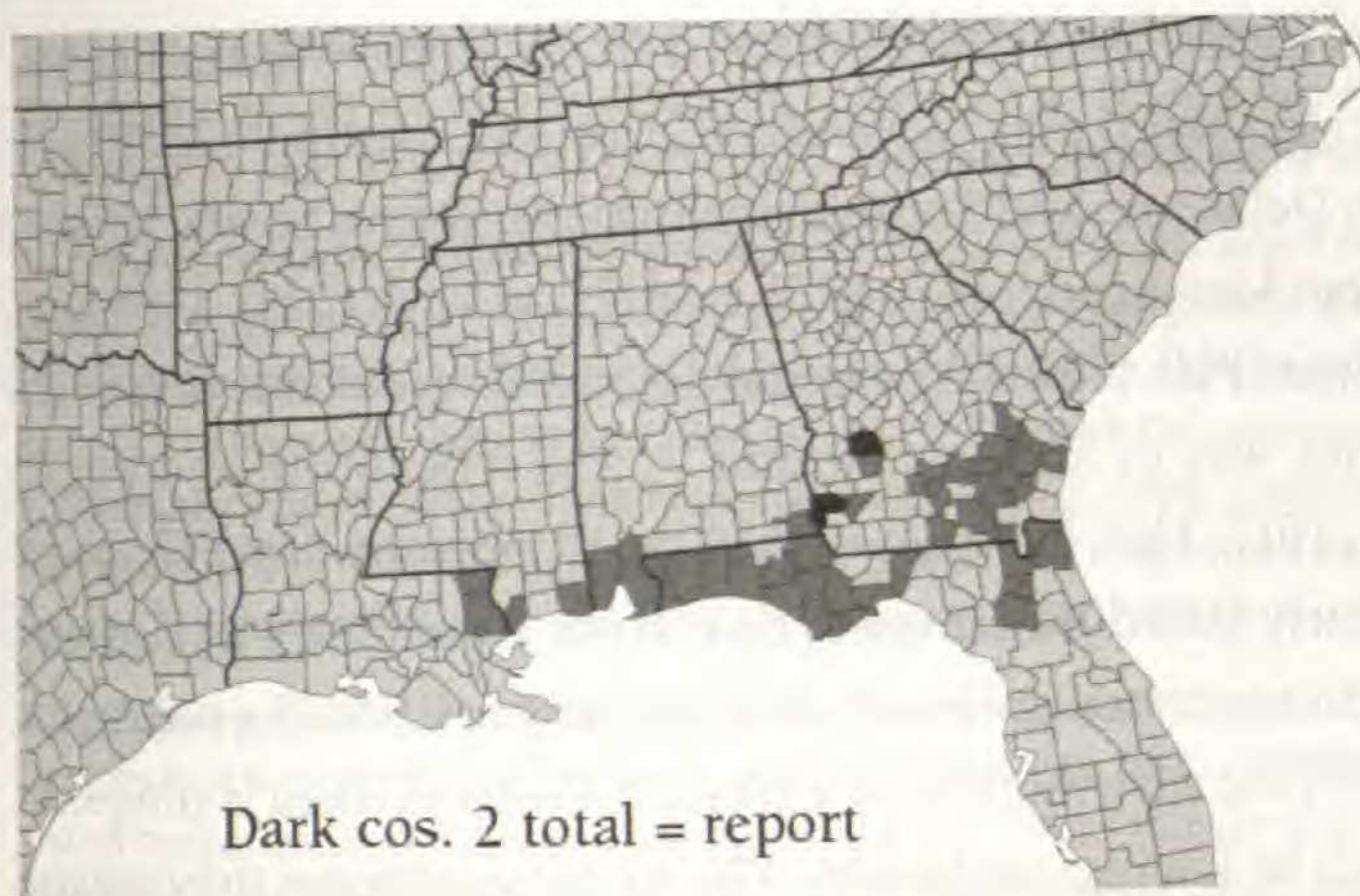
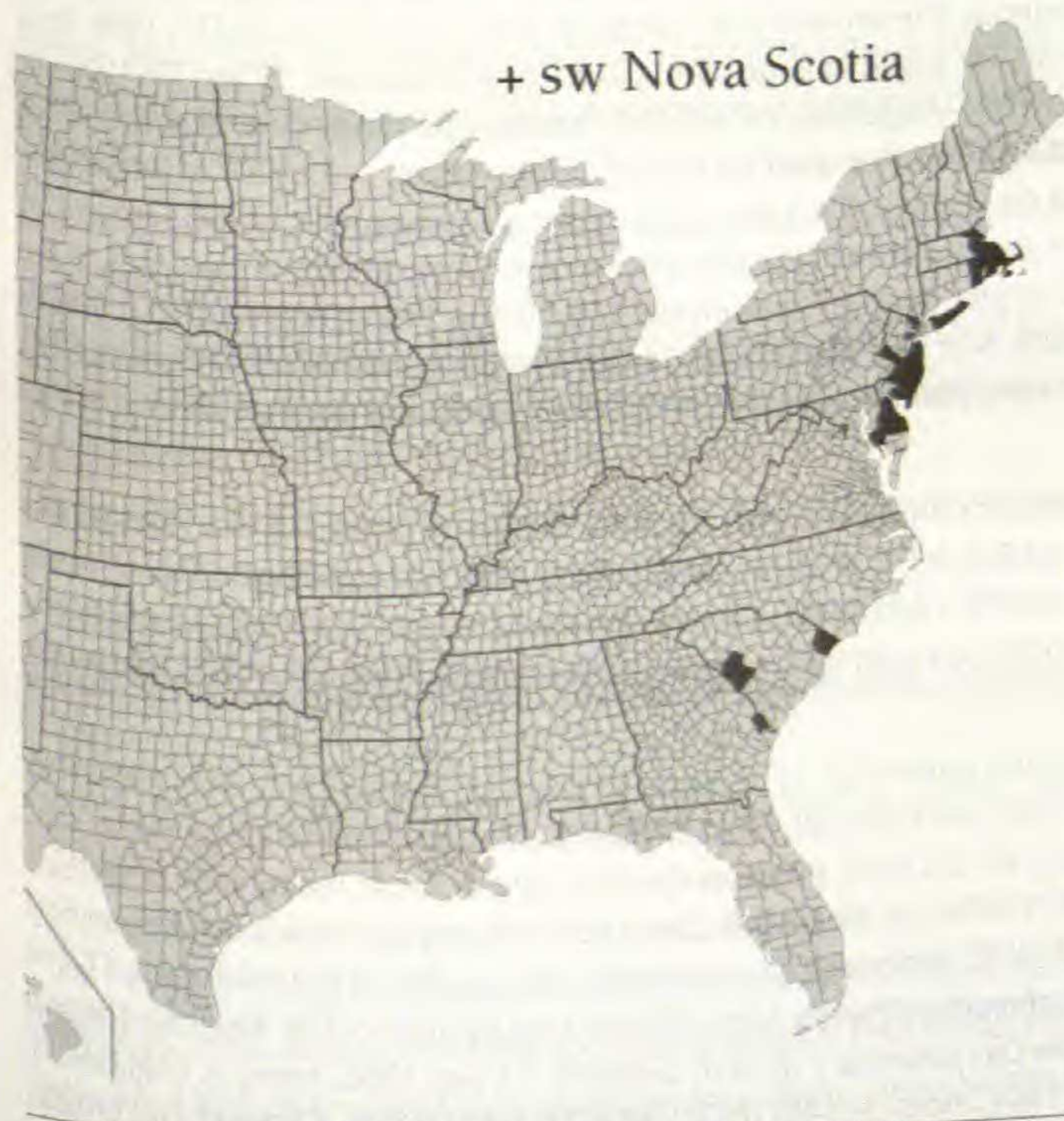


FIG. 7. Known distribution of *Coreopsis integrifolia*.



FIG. 8. Known distribution of *Coreopsis linifolia*.



FIG. 9. Known distribution of *Coreopsis nudata*.FIG. 10. Known distribution of *Coreopsis palustris*.FIG. 11. Known distribution of *Coreopsis rosea*.

**8. *Coreopsis palustris*** Sorrie, J. Bot. Res. Inst. Texas 5:439. 2011.

Since its inception, *C. helianthoides* Beadle has been a misunderstood and often neglected species. In part this is due to the general paucity of specimens in herbaria and in part due to Beadle's erroneous protolog. Beadle (1898) designated a type [Aspalaga, Florida, October 1897, A.W. Chapman s.n. (Biltmore Herb., holotype perhaps destroyed; isotypes MO!, US!)], but the specimens actually are *C. gladiata* Walter, due to the presence of broad-bladed leaves at all basal and lower culm nodes, and collected hundreds of kilometers outside of the proven range of *C. helianthoides*. We recommend that the name *C. gladiata* Walter be conserved for Walter's plant; Smith has designated a neotype (see above). Therefore, the entity known as *C. helianthoides* has been assigned a new name: *C. palustris* Sorrie (Weakley et al. 2011). The salient features of this highly distinctive species have been overlooked by practically all authors except Radford et al. (1968). Its leaf phenology is matched only by *C. aristulata*, with the lower 4–6 leaves senescent or deciduous by anthesis, thus leaving the lower nodes essentially naked. *Coreopsis palustris* is notable for the very broad achene wings (0.5 mm), matched only by *C. nudata*. *Coreopsis palustris* often grows prostrate with ascending distal portions of stems, perhaps due to relatively frequent inundation; of the species in section *Eublepharis*, only *C. palustris* and *C. integrifolia* inhabit communities that are subject to river or stream overflow. *Coreopsis palustris* inhabits swamp forests and openings, fresh tidal creek margins, marshes, and borrow ponds. It ranges from southeastern North Carolina to Duval County, Florida (last collected there in 1898) (Fig. 10). Georgia specimens of *C. palustris* are extremely rare: Camden County, 1 mi N of Kingsland, 18 Oct 1950, Godfrey 50908 (FSU, NCSC). Flowering dates: mid August–late October.

**9. *Coreopsis rosea*** Nutt., Gen. N. Amer. Pl. 2:179. 1818.

The distribution of no other species in section *Eublepharis* has been as under-represented in



manuals and monographs as that of *C. rosea*. For example, Smith (1976) maps it in six states (Massachusetts, Rhode Island, New York, New Jersey, Delaware, and Maryland) plus Nova Scotia, Canada. Strother (2006) lists six states (Massachusetts, Rhode Island, New Jersey, Delaware, and South Carolina) plus Nova Scotia. However, there are specimens dating as far back as 1903 from Maryland (MO), 1871 from New York (GH), 1865 from Pennsylvania (GH, MO), and 1900 from South Carolina (PH). Nuttall's original discovery was made in Georgia in October 1815: "about 20 mls. from Savannah on my way to Augusta I found . . . and a beautiful new purple flowered species of *Coreopsis*!" (Graustein 1967, p. 101). This location would be in present-day Effingham County. Nuttall's original description of *C. rosea* clearly stated that it occurred "from New Jersey to Georgia" (Nuttall 1818, p. 179). Finally, there is a Leavenworth specimen collected in Georgia pre-1862 (Leavenworth s.n. PH), as reported by Smith (1978). Figure 11 shows the distribution by county. *Coreopsis rosea* is unique in the section in its very short and narrow achenes which lack wings and awns. The awnless achenes may suggest affinity with some other section of the genus, as was done by Sherff (1936)—section *Calliopsis*—but molecular data is needed to guide current decision-making. *Coreopsis rosea* inhabits sandy to stony shores of ponds, lakes, and other depressional wetlands, plus sandy margins of Waccamaw River, South Carolina. Flowering dates: mid Jul–late Sep.

## APPENDIX 1

## SELECTED SPECIMEN RECORDS

1. ***Coreopsis aristulata***. All known specimens are listed above in the paratypes section.
2. ***Coreopsis falcata***. **GEORGIA**: no county, location, or collector s.n. (GH). **NORTH CAROLINA. Brunswick Co.**: pine/mixed graminoid savanna on W side of rte. 211, Green Swamp, 14 Sep 1985, Taggart 188 (NCU). **Jones Co.**: sandy peat at pocosin edge, U.S. 70, 28 May 1977, Kral 60220 (USCH). **Richmond Co.**: Sandhills Game Land, Nursery Lane at headwaters of Bones Creek, peaty mud in streamhead pocosin, 3 Jun 1998, Sorrie 9755 (NCU). **SOUTH CAROLINA. Berkeley Co.**: ponds in the pineland near Pinopolis, May–Jun [no year], Ravenel s.n. (USCH). **Colleton Co.**: savannah ecotone with *Collinsonia* and *Lobelia*, west of jct. of S-172 and S-28, 7 June 1984, Rayner 1940 (USCH). **Oconee Co.**: Seneca, June 1888, McCarthy s.n. (NCU). **Virginia**: City of Chesapeake, inundated bald cypress woodland bordering fresh tidal marshes along Northwest River, 26 May 1995, Fleming 10435 with Caljouw (GMUF, WILLI).
3. ***Coreopsis floridana***. **FLORIDA. Dixie Co.**: common in low wet sandy ditch by U.S. alt. 27, 11.4 mi NW of Shamrock, 31 Oct 1974, EB Smith 1840 (FSU, UARK, US). **Franklin Co.**: low pine barrens, Apalachicola, 22 Sep 1879, Biltmore Herb. 2066b and 2066c [apparently Chapman collections] (MO, NCU, NY). **Polk Co.**: 20 mi E of Lake Wales at Fed Haven, flat undrained land, 29 Nov 1965, Conard s.n. (NCU).
4. ***Coreopsis gladiata***. **ALABAMA. Henry Co.**: mucky bottoms of Foster Creek where crossed by Ala. 95, 18 Oct 1969, Kral 37970 (FSU). **Mobile Co.**: shrubby to open seepage slope (poor fen) off CR 96, 18 Oct 1996, Sorrie 9127 (NCU). **Washington Co.**: 5 mi S of Fruitdale, common in bog below oak-pine woods, 7 Oct 1967, McDaniel 9906 (FSU). **FLORIDA. Duval Co.**: near Jacksonville, Curtiss 4487 (MO). **Okaloosa Co.**: Blackwater River State Forest, abundant in sphagnous streamhead and roadside ditches by FR 50, 26 Oct 1998, Sorrie 10043 with LeBlond (NCU). **GEORGIA. Bartow Co.**: muddy open area at edges of large spring just S of Aubrey Lake, 19 Sep 1951, Duncan 13189 (MO, NCSC). **Glynn Co.**: edge of wet woods, rte. 99, 4 Oct 1982, Angerman s.n. (USCH). **Turner Co.**: sandy peat of pineland bog by Ga. 32, 5.2 mi W of Ga. 125, 25 Sep 1975, Kral 56823 (MO). **MISSISSIPPI. Forrest Co.**: bog in longleaf pine, 1–2 mi SW of Geiger Lake, Johnson State Park, 25 Oct 1971, Rogers 7137-G (MO). **Pearl River Co.**: 2 mi N of Picayune, open sphagnum bog, 4 Oct 1968, Sargent 9787 (MO). **Perry Co.**: abundant in hillside seepage bog with *Parnassia grandifolia* and *Rhynchospora macra*, Camp Shelby Impact Area, 19 Sep 1996, Leonard 12310 (NCU). **NORTH CAROLINA. Henderson Co.**: in bog, East Flat Rock on rte. 176, 10 Aug 1937, Coker s.n. (NCU). **SOUTH CAROLINA. Berkeley Co.**: Francis Marian National Forest, roadside N of Red Bluff Creek, 24 Oct 1995, Marshall 44 with Porcher (USCH). **Greenville Co.**: Double Springs piedmont seepage forest, 15 Oct 1999, Pittman 10159903 (MO, USCH). **Richland Co.**: Fort Jackson, Buffalo Creek Natural Area, 31 Oct 1995, Pittman 10319504 (USCH).
5. ***Coreopsis integrifolia***. **FLORIDA. Calhoun Co.**: wooded banks of Chipola River by rte. 20 W of Blountstown, 18 Oct 1990, Godfrey 84014 (GH). **Nassau Co.**: Brandy Branch Swamp, S of Bryceville, 24 Sep 2000, Anderson 19485 (MO). **GEORGIA. Calhoun Co.**: on slopes a few feet above water level, 30 Oct 1974, EB Smith 1838 (FSU). **SOUTH CAROLINA. Charleston Co.**: S end of Cox Road, 2.5 mi NNW of Parkers Ferry, 22 Sep 2004, Nelson 25076 (USCH). **Horry Co.**: abundant on a silt bar on shore of Waccamaw River, SW of S-31 bridge, Red Bluff Landing, 10 Oct 1985, Rayner 2248B (USCH).
6. ***Coreopsis linifolia***. **ALABAMA. Geneva Co.**: roadside and savanna south of jct. of highway 53 and 153, 25 Aug 1966, Clark 7682 (NCU). **Washington Co.**: low area in pineland ca. 4 mi N of Topton, 3 Oct 1966, Clark 8818 (NCU). **FLORIDA. Leon Co.**: roadside along Helen Guard Station Road about 15 mi S of Tallahassee, 13 Sep 1993, Henderson 93-325 (MO). **Putnam Co.**: frequent in moist loamy sand of roadside depression along rte. 19, N side of Palatka, 15 May 1997, Anderson 17437 (FSU). **GEORGIA. Cook Co.**: low seepage area (pitcher plant bog) alongside Ga. 76, 2.7 mi NE of Barney, 21 Sep 1965, Faircloth 3002 (NCU). **McIntosh Co.**: along the grassy edge of the road, route 17, 4 mi N of Darien, 4 Oct 1982, Angerman s.n. (USCH). **LOUISIANA. Natchitoches Parish**: large hillside bog beside FS 380, Kisatchie National Forest, 17 Sep 1988, Thomas 107284 (MO). **MISSISSIPPI. Harrison Co.**: savanna 2 mi N of Gulfport, 14 Sep 1966, Jones, Jr. 10347 (NCU). **Lamar Co.**: longleaf pine woods 8 mi W of Hattiesburg, 13 Sep 1964, Jones, Jr. 2488 (NCU). **NORTH CAROLINA. Carteret Co.**: Croatan National Forest, grass savanna on Millis Road, 4 Oct 1975, Wilson 1564 (NCU). **Harnett Co.**: seep in longleaf pine hills, N side of Spout



Springs, 18 Sep 1977, *Kral 60960* (MO). **SOUTH CAROLINA. Charleston Co.:** cut-over savannah, 2 Aug 2002, *Nelson 23113* (USCH). **Hampton Co.:** flat pine woods 0.8 mi NW of Brighton, then 0.8 mi WSW, 9 Sep 1956, *Bell 18242* (NCU). **TEXAS. Houston Co.:** Grapeland, sandy open bogs, 16 Sep 1918, *Palmer 14418* (MO). **VIRGINIA. Nansemond Co.:** boggy area ½ mi W of Kilby, 28 Sep 1967, *Harvill 17521* (MO).

**7. *Coreopsis nudata*. ALABAMA. Baldwin Co.:** very wet grassy area E of Gulf Shores, 1 May 1965, *Koelling 2199* (NCU). **Florida. Alachua Co.:** wet depression near Fairbanks, 6 Apr 1938, *Correll 8944* (DUKE). **Okaloosa Co.:** Eglin Air Force Base, cypress-Hypericum pond just SW of Test Facility 121, 16 May 1996, *Sorrie, LeBlond, Chafin* sight record. **GEORGIA. Brantley Co.:** shallow water of flats by road from Brunswick to Waycross, May 1933, *Coker s.n.* (NCU). **Tattnall Co.:** wet pine barrens near Collins, 4 Jul 1901, *Harper 1001* (GH). **LOUISIANA. St. Tammany Parish:** Abita Creek Preserve, wet savanna, 1996, *Smith & McInnis* (LA Natural Heritage Program database). **MISSISSIPPI. Hancock Co.:** 0.5 mi N of Dead Tiger Creek, 26 Apr 1981, *McDaniel 24970* (FSU). **Jackson Co.:** grassy roadside ditch in *Pinus palustris* savanna, U.S. 90 W of Pascagoula, May 1954, *Wood, Jr. 8462* (NCU).

**8. *Coreopsis palustris*. FLORIDA. Duval Co.:** border of low thicket near Jacksonville, 5 Nov 1898, *Curtiss 6302* (NCU). **GEORGIA. Camden Co.:** 1 mi N of Kingsland, 18 Oct 1950, *Godfrey 50908* (FSU, NCSC). **NORTH CAROLINA. Brunswick Co.:** clearing bordering swamp forest and on stream bank, Bell Swamp near Winnabow, 27 Oct 1950, *Godfrey 50957* (holotype: NCSC; isotypes FSU, MO). **Jones Co.:** marsh on Trent River, 5 mi NE of Pollocksville, 4 Oct 1953, *Radford 7684* (NCU). **SOUTH CAROLINA. Berkeley Co.:** swamp forest along CR 172, 18 Oct 1968, *Leonard 2162* (USCH). **Jasper Co.:** boggy meadow on SC 652, 9 Oct 1987, *Uttal 14847* (NCU).

**9. *Coreopsis rosea*. NOVA SCOTIA. Yarmouth Co.:** peaty and cobbly beach of St. John (Wilson's) Lake, 23 Jul 1921, *Fernald 24687* (GH). **DELAWARE. Sussex County,** shore of Tubbs Pond, Milford, 10 Sep 1931, *Goodale s.n.* (DUKE). **GEORGIA:** no data, *Leavenworth s.n.* (PH). **MARYLAND. Caroline Co.:** Denton, 21 Aug 1903, *Norton s.n.* (MO). **MASSACHUSETTS. Dukes Co.:** in shallow water of Seth's Pond, West Tisbury, Martha's Vineyard, 7 Sep 1917, *Seymour 1384* (GH). **Plymouth Co.:** in sandy flooded places, 1842, *Oakes s.n.* (GH, MO). **NEW JERSEY. Atlantic Co.:** ditches along abandoned railroad, Egg Harbor City, *Mackenzie 8049* (NCU). **Cumberland Co.:** Millville, Hankens Pond on Petticoat Branch of Maurice River, 15 Aug 1926, *Adams 480* (GH). **NEW YORK. Suffolk Co.:** Artist's Lake, 14 Aug 1923, *House 9660* (GH). **PENNSYLVANIA. Bucks Co.:** swamp near Bristol, 11 Aug 1865, *Parker s.n.* (MO). **RHODE ISLAND. Providence Co.:** Lincoln, Spectacle Pond, 11 Sep 1900, *Collins s.n.* (GH). **SOUTH CAROLINA. Aiken Co.:** sink margins E of Monetta, 1971, *Massey 2983* (NCU). **Horry Co.:** scattered in small patches, partial to full sun, moist grassy habitat, E side of Waccamaw River at rte. 9, 18 Oct 1980, *Leonard 7447* (FSU).

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